Morphology Diversity and Selection of *Pinus sibirica*

Ninia A.Vorobjeva and Vladislav N. Vorobjev
Institute for Ecology of Natural Complexes 2, Academichesky pr., Academgorodok, Tomsk 634055, Russia

ABSTRACT The development characteristics variation of the vegetative structure in the different morphotypes trees crowns are regarded as a result of the genetic differentiation and environment interaction. The morphohysiological characteristics and the evaluation of their function in meaning the morphogeny of different sex and position of crown shoots are used to reveal means of morphotype forming in *Pinus sibirica*. It has been found that the differences of activity and direction was changed of shoots growth characteristics in ontogeny of trees with different growth and reproductive activity, and that the size of the individual meristematic layer in the vegetative and generative apex differ and increase with its age. Transmission from vegetative to the reproductive stage in contrast of age modification is correlated with the sudden increased of the medullar parenchyma size. Thus the intensification of mitotic activity in the medullar zone of the apex and the increase in apical size precedes the shoot feminization. The large activity of stem unit which correlated slightly with its unit stem change is inherent in the male and asexual tree morphotypes.
Key words: Morphotype growth, Reproductive, Selection.

INTRODUCTION

Knowledge of Murphy-physiological state of separate tissues and organs during morphogeny is one of basic conditions for determining the direction of development. So it is necessary to study the morphological and physiological regularities of growth and the reproduction. It is a condition to switch the development program to another in concrete condition of environment.

According to modern views, the change of vegetative development by generative is a result of genetic, tropic and hormonal genetic interactions. This interaction is provided with age and evocation changes of stem unit quality, their morphological and biochemical characteristics and development of suitable apex receptivity. This explains that the connections of sex revealing both with physiological and biochemical feature of organism and its previous growth are known for conifers.

In present work the changes of apical growth and branching in ontogeny and activity were investigated. The same reproductive trees of *Pinus sibirica* were used as objects. All these trees have the close characteristics of the vegetative development but very different feature of generative one. The 25 years old trees with different activity of apical growth(5.3 m and 4.6 m, respectively) were used as objects for study of the connection between the growth and the branching during period of the vegetative development.

As matter of fact the diversity of revealing degree of the generative feature became a basis for the connection of trees in three morphological types: male, female and asexual ones. Ontogeny of each morphotype is viewed as a natural model which shows opportunity of the development at the definite sign, and gives concrete data for each form of the trees and stage of the ontogeny. Knowledge of the ontogenetic behavior of each morphotype is necessary to mark objectively their productivity and posterity growth. At the other hand it offers the opportunity to use ones as objects for selection. Significance of growth of sexualization, female one in particular, is determined by activity of branching change in quality and quantity in the ontogeny. Proliferation of meristematic cells and merits size of hill axoninitiation layers determines both the size of the parenchyma tissues (bark and medullar) and the activity of the branching. This immediate link of stem axis histogeny and age as well as evocation reconstruction of the apex structure is used for estimation of their activity at the consistent ontogeny stages and is significant for the generative and vegetative branching.

The activity of the ontogeny change of the bark: medullar parenchyma size ratio (B: M) in shoot axis became criterion of the estimation mentioned above. The paper has an aim to concrete morpological and histogeny conditions for separate stages of the sexualization and role of the growth. It is supposed that simultaneous comparative study of the histogeny and apical growth change in female and vegetative shoots axes is permitted to show some details of relation between the apical activity, branching, sexualization and some regularities that determine the type of the development in the ontogeny.

RESULTS AND DISCUSSIONS

Table 1. Growth shoots in different tree morphotypes

Shoot F_b	Tree F_a			
	Female	Male	Asexual	F_{fact}
	Branch Age (year)			
Vegetative	41.2	37.8	54.4	-
Vegetative	69.3	74.4	88.9	-
Female	80.8	86.1	100.6	-
	Axis Length (cm)			
Vegetative	3.19	2.53	3.41	F_a-2.81
Vegetative	3.85	8.26	8.65	F_b-53.8
Female	11.16	13.54	14.94	F_x-13.2
	Axis Diameter(cm)			
Vegetative	0.53	0.50	0.53	F_a-0.47
Vegetative	0.70	0.79	0.94	F_b-59.1
Female	1.41	1.46	1.27	F_x-13.2
	Parenchyma of Bark/Medulla(B/M)			
Vegetative	5.5	6.5	7.1	
Vegetative	4.1	3.8	3.8	
Female	1.8	2.1	1.9	
	Brachyblasts on Axis			
Vegetative	18.7	18.8	19.3	F_a-2.04
Vegetative	21.00	27.8	45.9	F_b-27.5
Female	50.8	63.7	71.8	F_x-6.25
	Auxiblasts on Axis of First Bud			
Vegetative	0.50	0.80	0.56	F_a-1.46
Vegetative	0.75	2.10	1.80	F_b-27.5
Female	0.80	1.90	1.40	F_x-6.25
	Auxiblasts on Axis of Second Bud			
Female	2.4	2.6	2.5	F_a-2.04
	Generative Primordia, on Axis/ % Sum			
Female	2.7/5.0	2.1/27.1	1.0/41.4	

Knowledge about particularity of morphological changes in ontogeny of individual tree form is limited. Analysis of the relationship of the shoot growth and sex is confirmed by the correlation between the sixualization with all values composing the growth, and absence of direct dependence of differences in rate of variability on stage critical value of the change (Table 1). The role of each factors is inconsistent. The sexual type of the tree has not direct correlation with the growth characteristics. But indirect correlation is a result of interaction of the growth with other organized factors (F_x).

As this takes place the age changes of brachyblast and auxiblast numbers are slower in vegetative shoot whorl of the female tree morphotype in comparison with one of the male and asexual morphotypes. Simultaneously the reproduction of these type trees began in earlier time in comparison with the male and asexual one (40-45 years and 60 - 45 respectively). It is showed that the stem unit change in this kind of trees at the vegetative development stage is more.

By contrast, the size of the vegetative branching is not practically changed when the sex of the shoot switches over. At the same time the number of brachyblasts at shoot axis is significantly increased. The female shoots have lowest level of vegetative branching but higher size and higher percentage of generative one in the female tree morphotypes.

These data give the basis to propose that the evocation changes of this tree morphotype increase the activity of brachyblast and cone initiation. From this point of view, the data analysis shows that stem unit variability of the vegetative development is bigger and vegetative morphogenetic time of the female tree morphotype is shorter. These trees also conserved higher rate of the evocation changes in the beginning of their reproduction.

The growth and branching dynamics up to the last ten years were compared in two tree groups differed by the apical growth activity. Differences have not been found between averages of ones. The checking up for presence of trend in branching dynamics by Foster-Stjuart's method (Plohinsky 1961) showed the absence of trends in means of branching average and dispersion. Its data said about liability of sign and dependence on one from accidental factors.

At the same time the temp of ontogenic branching rise is significantly low in the trees which have larger apical growth (0.03 against 0.005, respectively). The theoretical model of branching pass and rise of its size in the ontogeny showed that ones are larger in group of higher trees. The sizes of theoretical and experimental branching were compared in this tree group. The first of them were in 1.3 time greater. Simultaneously these trees often form two whorl in the vegetative season.

It is well known fact that the higher mitotic activity is started at the fist in medullar merits cell of herbaceous plants before transition to flowering (Aksenova et al.1984). The size of individual meristematic layer is considerably difference in the vegetative apex also. Difference between the size of the parenchyma tissue in the shoots of asexual and that of female types may be considered as a result of these changes.

The age modification of the bark and medullar parenchyma tissue size of the shoot axis are not the same. The modifications of each them along ontogenetic stage are also differed (Table 2). The medullar parenchyma size is more actively increased with its age in the period of the vegetative development. So the share of the participation of the medullar parenchyma is increased but

that of the bark parenchyma is decreased.

The value of B/M is decreased accordingly. In the different tree morpotypes the direction of these changes are the same, but the rate is higher in the male and asexual tree types, and less in the female ones. This specificity supposes the various duration of the vegetative stage.

Table 2. Histogeny of shoot axis in different tree morphotypes

Sex type of shoot	Branch age, (year)	Parenchyma of diameter size: Bark	Medullar	B/M
		Female Tree Morphotype		
Vegetative	30-35	67.4±0.74	12.4±0.52	5.6±0.22
Vegetative	65-70	67.2±0.75	16.4±0.36	4.1±0.12
Female	65-70	50.0±1.12	28.9±1.34	1.8±0.12
		Male Tree Morphotype		
Vegetative	35-40	70.2±0.64	11.1±0.40	6.5±0.25
Vegetative	75-80	65.8±0.58	17.6±0.40	3.8±0.10
Female	75-80	55.5±0.77	27.2±0.48	2.1±0.07
		Asexual Tree Morphotype		
Vegetative	65-70	70.4±0.47	10.1±0.36	7.1±0.33
Vegetative	85-90	64.9±0.81	17.1±0.40	3.8±0.12
Female	85-90	53.5±0.73	28.3±0.78	1.9±0.06

Transmission from the vegetative to the reproductive stage in contrast of age modification is correlated with the sudden increase of the medullar parenchyma size and decrease of the bark one. Rate of this variation is uneven in the different tree morphotypes. The highest rate is in the female tree morphotype now.

Nevertheless the evocation changes just before the sex revealing are related with additional increase of the medullar parenchyma and with decrease of the B/M axis value less than 2,5 inspire of the tree morphotype. It is obviously that the age and evocation variation have the same direction but different rapidity. The reason of these changes is not identified.

Analysis of the growth of the axis tissue parenchyma shows that the number of the cells but not their size is a reason of age dimension increase in the bark parenchyma (Table 3). The cause for the medullar parenchyma changes is the cell number and size.

The alteration of the shoot sex is connected with runs into increase of the parenchyma cell numbers twice at any rate. These data are anological results of the cytological study of herb(Milyaeva 1984).The flowering was correlated with greater activity of the medullar meristematic cells. It is one of the causes according to the size of analogical meristematic zones which is significantly differed between vegetative and evocation apices.

Table 3. Morphometric characteristics of parenchyma tissue in axis of female and vegetative shoots

Parameters of tissue growth	Female shoots	Vegetative shoots on branches age (year): 70 years	50 years
	Medullar		
Tissue size, mm	8.3±0.6	2.8±0.4	1.5±0.2
Cell number	11.0±8.3	46.7±5.3	32.8±3.9
Cell size, mc.	72.0±1.0	60.0±2.0	47.0±2.0
	Bark		
Tissue size, mm	9.3±0.3	6.9±0.3	5.8±0.5
Cell number	154.0±5.1	124.0±5.9	106.5±9.2
Cell size,mc.	60.0±1.7	56.0±0.5	55.0±9.0

These data confirmed the availability of the connection between sex and histogeny of the shoot axis but not only diameter one. The latter feature as a result of the age and evocation variation in the individual tissue growth. The growth peculiarities of each tissues determines specificity of the histogeny and duration of the vegetative period of the different tree morphotypes.

The shoot sexualization conjugates with the additional sharp increase of the medullar parenchyma size. It is caused the expense of the cell number under an influence of the evocation changes is not same in the different tree orphotypes, most in the female one.

Thus the connection of the axis histogeny and sexualization with the each from the factors mentioned above is not simple. It is possible that other unknown reasons exist. There is obvious necessity to continue the investigation of these problems.

REFERENCES

1. Aksenova, N. P., T. N. Bavrina, and T. N. Konstantinova 1984. Some difference in the regulation of floral expression during plant. Edited by M.Kh Chaylakhyan. Moscow, Nauka:141-157.

2. Plohinsky, N. A. 1961. Biometry. Novosibirsk, Naudk 366pp

(**Responsible Editor**: Zhu Hong)